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REMARKS

Claims 1, 3, 4, and 7 are amended. Claims 2, 5, 6, and 8 are cancelled without prejudice or disclaimer. Applicants reserve the right to file one or more continuing applications directed to the subject matter of these claims. Claims 10-19 are added. Hence, claims 1, 3, 4, 7, and 9-19 are now active and under consideration.

TiC is known as an additive to Wc-TiC-Co-based, solid carbide cutting tools to increase high temperature hardness and to inhibit reaction with stainless steel when cut. Recently, it was found that ultrafine powders of TiC-based carbides afford increased hardness to tools made therefrom, as well as increased traverse-rupture strength and wear resistance. Thus, it is desirable to produce TiC-based powder as fine as possible.

Unfortunately, conventional methods of producing TiC powder require expensive equipment and high power consumption. Moreover, particle sizes obtained are on the order of from 1-2  $\mu\text{m}$ . While these particles may subsequently be ball-milled, ball-milling introduces impurities into the milled power.

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The invention of claims 1-17 provides a method of producing a TiC-transition metal-based complex powder which avoids the above drawbacks. The powder of claim 18 is made by the process of claim 1. The product of claim 19 defines particles of the product of claim 18.

The rejection of claims 1, 3, and 7 under 35 U.S.C. §102(b) as being anticipated by Kim et al. (U.S. 6,293,989) and of claims 4, and 9 under 35 U.S.C. §103(a) as being unpatentable over Kim in view of Hardy et al. (U.S. 3,488,291) is overcome by the amendment to claim 1, upon which the remaining claims depend.

The subject matter of Claims 1, and 3 is not anticipated from the method of producing a WC/TiC/Co composite powder of Kim, nor is the subject matter of Claims 4 or 9 obvious from the process of Hardy. Further, the effects obtained by the method of Claims 1, 3, 4, 7 and 9-15 would not be expected by one skilled in the art.

According to Kim, the method of preparing a WC/TiC/Co composite powder entails dissolving salts containing W, Ti and Co into an aqueous solution; spray-drying; heating; adding carbon; and heating the resulting powder for reduction and

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carburization, wherein the major component is WC, and TiC and Co are metal alloy components added thereto.

In contrast, the method of amended claim 1 differs from Kim et al. and Hardy et al. by requiring a Ti containing water-soluble salts, or a  $\text{TiO}(\text{OH})_2$  slurry, or ultrafine titanium oxide powder and a transition metal-containing water-soluble metal salt in water to be dissolved or dispersed with each other. Such a step is not disclosed by Kim et al. and/or by Hardy. Neither of the references discloses the foregoing materials that enable production of a powder that overcomes the previously mentioned drawbacks of the prior art and which do not appear to be in the product produced by the Kim and Hardy methods.

In part, due to the difference in the composition between Kim and the method of Claim 1, different processes for powder formation are employed. In preparing a powder according to Kim, a W-Ti-Co-based composite oxide powder having W as a major component is formed from a spray-drying/ heating process for removing salts and moisture. After adding carbon to the oxide powder, the mixture is heated with reductive gas or non-oxidative gas.

During heating, firstly, at around 600-900°C, W oxide and Co oxide are reduced by hydrogen and carbon and carburized by

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carbon to form a WC phase (major phase) and a Co phase as an alloy component. After forming WC and Co as such, the reaction is promoted; thus, Ti-based oxide is reduced by carbon and hydrogen at about 1300°C or more to form TiC. In the above, WC and TiC dissolve each other in the solid state; therefore, (W,Ti)C composite carbide is formed. The WC formed in advance facilitates the formation of TiC, and finally a WC-TiC-Co composite powder is obtained. Thus, the method of amended claim 1 differs from that of Kim, and Hardy does not cure the deficiencies of the Kim reference vis a vis amended claim 1.

Based on thermodynamic considerations, it is very difficult to form a TiC phase from titanium oxide by using carbon through a reduction/carburization process at 1200-1350°C, as required by claim 9. That is, one skilled in the art would have no reason to expect that TiC would be formed at 1200-1350°C. However, by the virtue of the method of Claim 9, an ultrafine Ti-Co powder is obtained.

Hardy merely describes how metal oxide can react with carbon to directly reduce to metal carbide or, in the alternative, the metal oxide can be first reduced to free metal and then carburized to metal carbide. However, this description would be insufficient to either motivate or enable one skilled

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in the art to modify the description of Kim in order to obtain the subject matter of Claims 1, 4 or 9.

New claim 17 distinguishes over Kim et al. by precluding ball-milling. Claim 1, step (iii) of Kim et al. as well as Figure 1 and col. 2, lines 56-63 indicates ball-milling is essential. Paragraph 4 on page 2 of the present specification makes clear that ball-milling is to be avoided as it introduces impurities into the powder.

The method of Hardy et al. is very different from that of method Claims 1, 3, 4, 7 and 9-15. Specifically, in Hardy et al., a mixture is first formed of carbon black and a liquid medium having dissolved therein (A) a metal compound which can be converted to the corresponding metal carbide by reaction with carbon, and (B) a metal compound which can be converted to the corresponding free metal in the presence of carbon. Then, this mixture is spray-dried and heated to form a mixture of metal (A) carbide and free metal (B).

In contrast, the method of Claim 1 (and all claims dependent thereon) requires calcining a precursor powder to first form Ti-transition metal complex oxide powder. Then, nano-sized carbon is added to this powder, and then the mixture

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is subjected to reduction/carburization in a non-oxidizing atmosphere.

Hence, the manipulative process steps of Hardy et al. and Claims 1, 3, 4, 7 and 9-15 are very different. Moreover, neither Kim et al. nor Hardy et al. discloses or suggests the use of nano-sized carbon. In fact, Kim et al. disclose ball-milling of oxide aggregates and carbon black to produce an "ultra fine size." See col. 4, lines 13-22. Hardy et al. do not specify the size of the carbon black particles used, however, the resulting aggregate particle sizes in Example 1 are "about 40  $\mu\text{m}$ " and those of Example 2 are "about 50  $\mu\text{m}$ ." These are decidedly not nano-sized particles. Nano-sized particles are important with respect to lower process temperatures and improved physical properties in products made from the resulting complex powder.

Hence, both grounds of rejection are unsustainable and should be withdrawn.

Claims 1-9 stand provisionally rejected under the judicially created doctrine of obviousness-type double-patenting as being unpatentable over claims 1-8 of copending Application Serial No. 10/747,655. Upon an indication of allowable subject

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matter, a Terminal Disclaimer will be submitted to render this provisional rejection moot.

Finally, attached herewith is an Information Disclosure Statement based upon information cited in copending Application Serial No. 10/747,655, not yet of record in the present application.

To the extent necessary, Applicants hereby request an extension of time under 37 C.F.R. §1.136 and hereby authorize the Commissioner to charge any omitted fees, including application processing, extension, and extra claims fees, to Deposit Account No. 07-1337.

Respectfully submitted,

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